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Earplug technology is industry leader

by John Schutte, AFRL Human Effectiveness Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Is the earplug that Carlos Santana wears when he sings Black Magic Woman really the same technology used by U.S. Air Force fighter pilots? Well, almost, thanks to a unique collaboration between the federal government and a commercial hearing healthcare laboratory.

This project by the Air Force Research Laboratory began with earplug technology from Westone Laboratories, Inc. Westone is widely recognized as the industry leader in hearing healthcare products, including in-ear music monitoring devices used by Santana and other top recording artists.

Using the Westone technology as a baseline, AFRL's Human Effectiveness Directorate (AFRL/HE) developed the Attenuating Custom Communications Earphone System (ACCES), which improves hearing protection not only for military ground crews and pilots, but for industrial workers such as construction crews, heavy equipment operators and commercial airline employees.

By integrating specialized electronics and a voice communications cable into a custom-molded earplug, the technology allows clear communications while simultaneously protecting the ear from damaging audio frequencies; that is, above 105 dB SPL (sound pressure level). Even when not under power, ACCES reduces noise by 30 dB. It weighs less than the

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The ACCES hearing protection system is attached to an HGU-55P flight helmet system, configured as it would be for operational use in an Air Force aircraft. The Air Force Research Laboratory developed ACCES to improve hearing protection for military ground crew and pilots and industrial workers. (Air Force photo)

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AFRL teams up to test SensorCraft wing

by *Melissa Withrow, AFRL Air Vehicles Directorate*

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Force Research Laboratory, Northrop Grumman Corp. and NASA teamed together on the High Lift/Drag Active (HiLDA) Wing Program to successfully demonstrate a 12-percent scaled model of a highly elastic SensorCraft concept wing.

During a series of wind tunnel tests at NASA's Transonic Dynamics Tunnel, scientists subjected the wing to conditions similar to steady, smooth flight as well as flight in more extreme conditions with erratic wind gusts. During the steady flight conditions, scientists reduced the wing's drag by making slow and deliberate adjustments of the wing's control surfaces in order to maximize its lift-to-drag ratio.

During the gusty conditions, scientists alleviated structural loads on the wing by continuously making small adjustments with the control surfaces. In the future, this ability will increase SensorCraft's capabilities and enable it to remain on station longer by enabling much lighter wing structures to endure encounters with gusts.

Engineers are developing the SensorCraft concept as a future intelligence, surveillance and reconnaissance platform that will collect intelligence using fully integrated sensors. In support of the SensorCraft concept, the HiLDA program will evaluate active wing technologies including active flow control, adaptive structure and active aeroelastic wing (AAW). This portion of the HiLDA wing program studied AAW's applicability to the SensorCraft concept.

AAW technology takes a traditionally detrimental condition, like the tendency of wings to warp or twist at high speeds, and transforms it into an advantage using elastic wings. AAW has traditionally been used to provide large amounts of roll power using conventional control surfaces. In this application, AAW is used to alleviate structural loads quickly during gust events and to twist the wing adaptively to minimize overall aircraft drag. AAW technology will enable thinner, higher-aspect ratio wings, which can greatly reduce air vehicle weight and improve performance. @

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AFRL's Dr. Linderman named acting chief scientist

by Francis L. Crumb, AFRL Information Directorate

ROME, N.Y. — Dr. Richard W. Linderman, a member of the scientific and professional cadre of senior executives, has been named acting chief scientist for the Air Force Research Laboratory Information Directorate.

Dr. Linderman's appointment was announced by Dr. Donald W. Hanson, director of the Information Directorate. He will assume the duties of Dr. Northrup Fowler III, who retired Sept. 2 after a 27-year career in Air Force research and development.

Dr. Linderman, who previously served as the senior scientist for advanced computing architectures, was commissioned by the Air Force as a second lieutenant in May 1980. Upon completing four years of graduate studies, he entered active duty, teaching graduate computer architecture courses and leading related research at the Air Force Institute of Technology where he rose to the rank of associate professor.

In 1988, he was assigned to Rome Air Development Center to lead surveillance signal processing architecture activities. In 1991, he transitioned from active duty to Air Force civil service as a

senior electronics engineer at Rome Laboratory, becoming a principal engineer in 1997. During these years, he pioneered three dimensional packaging of embedded architectures and led the Department of Defense community exploring signal/image processing applications of high performance computers. In 1997, with the standup of the Air Force Research Laboratory, he served as technical advisor of advanced computing architectures. He became special assistant to the chief scientist in 2000 and held that position until being appointed a senior scientist in 2004.

Dr. Linderman earned a bachelor's and a master's degree and a doctorate in electrical engineering from Cornell University. He holds six U.S. patents and has published over 60 journal, conference and technical papers. He is a fellow of both AFRL and the Institute of Electrical and Electronics Engineers. @

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AFRL technology assists in Hurricane Katrina relief

by Marilyn R. Unroe, AFRL Material Laboratory

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A large bandwidth antenna technology, currently under development at the Air Force Research Laboratory, was recently used in support of the American Red Cross and first responders in the Biloxi, Miss. area. The Advanced Technology Demonstrator (ATD) antenna and its accessory components were requested by the Red Cross because of its broadband performance and its rapid deployment ca-

pability into a disaster area. The antenna system was used to establish satellite communications links for the first responders and local law enforcement officers at the command post. In addition, the assistance provided at the command post included helping local victims with on-line FEMA applications and personal internet and e-mail connectivity.

The antenna development was jointly funded by the Office of the Secretary of

Defense and the Air Force Small Business Innovative Research (SBIR) program and was built and characterized by SRS Technologies-Systems Technology Group, Huntsville, Ala.

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hard-plastic speakers mounted inside flight helmets and is cost-effective at about \$300 per set, depending upon the application. Flight evaluations show that ACCES is comfortable and provides a quiet environment inside a jet.

John Hall, AFRL/HE Science & Technology Lead for Acoustic Signal Control, said the program has leveraged a commercial industry for transition to a military application, and the value-added technology is now being transferred to other commercial applications.

"We partnered with a small business and developed cool technology for both military and commercial markets," Mr. Hall said.

According to Mr. Hall, the Air Combat Command recently approved ACCES for use in fighter aircraft. Previously, pilots and ground crews wore foam earplugs under their communication headsets, which caused problems because the foam plugs muffled all external noise, including important communications.

In September 2005, the U. S. General Services Administration awarded Westone a GSA schedule contract, which allows Westone to market and sell the product directly to military and commercial customers.

"This is a landmark example of technology transfer facilitating transition of products to the warfighter," said Augustine Vu, Air Force Technol-

ogy Transfer program manager.

AFRL initiated the research upon learning that the Veterans Administration treatment of hearing loss has cost taxpayers more than \$5.9 billion since 1977. Air Force maintenance crews also reported problems communicating with each other and with the cockpit when jet engines are in higher power settings.

For Westone, the potential exists to create a new commercial product line with possible applications in the automotive, motorsports and airline industries. The Air Force already has realized the potential for this product in military flight and ground applications.

Mike Melvill, pilot of the rocket plane SpaceShipOne, wore ACCES earplugs during his 2004 flight. Mr. Melvill said he "couldn't have heard anything" without the ACCES technology. Cabin noise reached levels of 120 dB, but Mr. Melvill said his communications with mission control were "perfect," and he had "no discomfort at all from the noise of the rocket motor."

Future improvements could include microphones for two-way communications, and "anti-noise" for improved noise suppression. @

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AFRL's ManTech launches information repository

by René Boston, AFRL Materials and Manufacturing Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Industrial Base Information Center (IBIC) has introduced an industrial base information web repository that will provide interested users with valuable insight into the world of Industrial Base Planning (IBP).

The IBIC, a support activity of the Air Force Research Laboratory's Materials and Manufacturing Directorate (ML), Manufacturing Technology (ManTech) Division, is the repository for detailed information and distributes such information to individuals within the Department of Defense, other government agencies and non-government recipients as authorized.

"This repository is the primary information source, reference and data integrator for obtaining existing detailed ManTech, Defense Industrial Base, Defense Production Act, and AFMC Acquisition and Logistics information needed in the execution of Air Force programs," said Alan R. Taylor, Industrial Base Planning program manager. Managed and operated for AFRL's Materials and Manufacturing Directorate by Nortel PEC Solutions, Inc., the IBIC provides Air Force activities the capability to rapidly research industrial base issues for the purpose of identifying their impact on Air Force materiel requirements.

To support this Air Force mission effectively, the IBIC actively subscribes to and/or maintains access to a myriad of information sources, internal and external as well as private and public domains, as part of a dynamic process that provides a timely, up-to-date and complete response to a customer's request for industrial base-related information.

Some of the information available through the IBIC is for official use only because it involves military critical technologies, or is

otherwise proprietary. Criteria for access to such data are strictly enforced, and requesters must have authorization to receive this data.

In order to make selected industrial base information more accessible to a wider community of users, the IBIC has developed an IBP community of practice that includes a repository of completed reports, studies and assessments prepared by a wide range of activities. Hosted through Air Force Knowledge Now (AFKN) and the Air Force Portal web servers, this repository of industrial base information is available to all government employees and contractors with AFKN/Air Force Portal login access credentials.

"The repository provides a simple search capability and includes an extensive collection of industrial base reports, analyses, and related documents prepared by the Air Force, numerous DoD offices and agencies, and other departments within the government," Mr. Taylor said.

The repository also holds all IBIC reports from the current time period and dating back as far as 1997. Industrial base sector-organized repository allows a user to access, read and copy or download any and all reports residing therein. As new projects and reports are completed, they are added to the repository, and users can provide feedback to the IBIC directly through the CoP site. This site can be accessed at <http://afkm.wpafb.af.mil/ASPs/CoP/OpenCoP.asp?Filter=OO-OT-RL-03>. @

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AFRL deputy director reaches out to future S&Es



WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Force Research Laboratory's Col. David A. Harris, deputy director of the Materials and Manufacturing Directorate (ML), provided students with an overview of the directorate's mission as part of the Students Exploring Advanced Technologies (SEAT) Program. SEAT is a collaborative partnership program between AFRL/ML, Dayton Public Schools and Wilberforce University and offers high school students who display an aptitude in mathematics and science the encouragement to pursue a college education in science and engineering. (Air Force photo by René M. Boston) @

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Firm foundation laid for premier research and development spacecraft

by Michael P. Kleiman, AFRL Space Vehicles Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — In 2004, the future of spacecraft dedicated to research and development arrived with the initiation of the Demonstration and Sciences Experiments (DSX) space flight program. Planned to launch in 2008 and inserted in a medium earth orbit of 10,000 kilometers, DSX will conduct experiments to advance the warfighter's communication, surveillance and navigation capabilities.

"It is designed to be the highly ambitious, as well as one of the largest research and development spacecraft flown by AFRL (Air Force Research Laboratory)," said Dr. Greg Spanjers, DSX program manager. "The program started in January 2004, and we are pleased to be ahead of the baseline plan for both schedule and budget."

Originally conceived by researchers at the AFRL's Space Vehicles Directorate, Kirtland Air Force Base, N.M., over two years ago for physics-based experimental objectives, DSX will consist of parts provided by approximately 15 different entities from the public and private sectors, industry, Department of Defense, NASA and academia. In addition, the spacecraft will carry science experiment payloads from the Defense Advanced Research Projects Agency (DARPA), Arlington, Va., NASA Goddard Space Flight Center, Greenbelt, Md., and the Air Force Research Laboratory's Propulsion and Space Vehicles Directorates. Although scheduled for launch in three years, the project has goals to achieve in the upcoming months and years including a preliminary design review of the spacecraft system this fall and a critical design review of the satellite in early 2006. Typical spacecraft programs will initiate fabrication only after the critical design review process. On the other hand, judicious use of standardized mechanical and electrical interfaces has enabled DSX to initiate fabrication on an accelerated schedule. Flight hardware fabrication is currently being performed for the spacecraft structure, avionics and several of the space weather payloads.

By mid-2007, the spacecraft bus will arrive AFRL's Aerospace Engineering Facility, Kirtland Air Force Base, initiating a six-month payload assembly integration and test-phase. Following these required procedures, the 400-kilogram spacecraft will be prepared for launch to an orbit regime known as the Medium Earth Orbit (MEO) slot region. This particular area, between about 8,000 and 12,000 kilometers, represents an attractive orbit for future communications and surveillance satellites because it has a lower radiation dose rate and sufficient altitudes to allow for global coverage. In addition, it is four times closer than geostationary (GEO) satellites, which increases speed of communications by a factor of eight. This attractive orbit has remained largely unexplored, with most commercial, military, and science satellites opting for low earth orbit (LEO) or GEO orbits.



Dr. Greg Spanjers, Demonstration and Science Experiments Program Manager, Air Force Research Laboratory's, Space Vehicles Directorate (right), discusses the research and development spacecraft project with Aaron Adler, contract aerospace engineer, Jackson and Tull (left), and Jason Guarnieri, aerospace engineer, from AFRL's Space Vehicles Directorate. (Air Force photo by Michael P. Kleiman)

A majority of the research satellites fly in LEO, between 400 and 2,000 kilometers, to reduce problems caused by radiation. A primary goal of DSX, however, is to conduct the characterization and basic research on the MEO environment needed to establish predictive models for future spacecraft designers. An equally important goal is to investigate potential methods for decreasing the space radiation around spacecraft so as to protect them from solar storms and other radiation sources. The three distinct experiments planned for DSX's year-long mission will significantly improve DOD's capability in this attractive orbital regime.

The Wave Particle Interaction Experiment (WPIx) will transmit and receive very low frequency waves in the 10 to 50-kilohertz range and quantify their effect on the trapped electron populations in the magnetosphere. DSX will also utilize ground transmitters and other space receivers to measure critical parameters such as VLF injection across the ionosphere and the far-field radiated patterns.

The DSX Space Weather Experiment (SWx) will characterize the high and low energy electron and proton fluence, radiation dose rates, local magnetic fields and pitch angle distribution or radiation particles in the slot region orbit.

The space environment effects experiment consists of NASA's Space Environment Testbed (SET), as well as several AFRL-developed photometers and radiometers. The SET will employ several sensors to characterize a broad spectrum of energetic particles and its effects on electronics, such as radiation displacement damage

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Due to the number of submissions we receive, some sections of *news@afrl* are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research Laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

L@b L@urels

- Non-lethal technology team wins top award
- AFRL researchers named as SPIE fellows
- Dr. Albanese receives life-times achievement award
- AFRL chief scientist named as next SPIE president
- AFRL engineer awarded for volunteer work

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To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

Jill.Bohn@wpafb.af.mil

General Carlson visits AFRL displays during convention



WASHINGTON, D.C. — Gen. Bruce Carlson, Commander, Air Force Materiel Command, gets a demonstration of 3-D audio technology from 1st Lt. Jonathan Lee from the Air Force Research Laboratory, during the Air Force Association Technology Exposition Sept. 13 in Washington, D.C. The 3-D audio technology, developed by AFRL's Human Effectiveness Directorate, helps pinpoint the direction of sound to give an immediate sense of where a threat or target is and spatially separates voices. (Air Force photo by Larine Barr) @

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"We have designed DSX to be a cutting edge base of research for the warfighter's needs for communication, surveillance, and navigation," Dr. Spanjers said.

AFRL's Space Vehicles Directorate will provide a bulk of the funding for the \$37 million spacecraft, but other financial contributors include DARPA, NASA and AFRL's Propulsion Directorate,

which is located at Edwards Air Force Base, Calif. Finally, the program is operating on schedule and on budget towards accomplishing a spacecraft bus critical design review in early 2006. @

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